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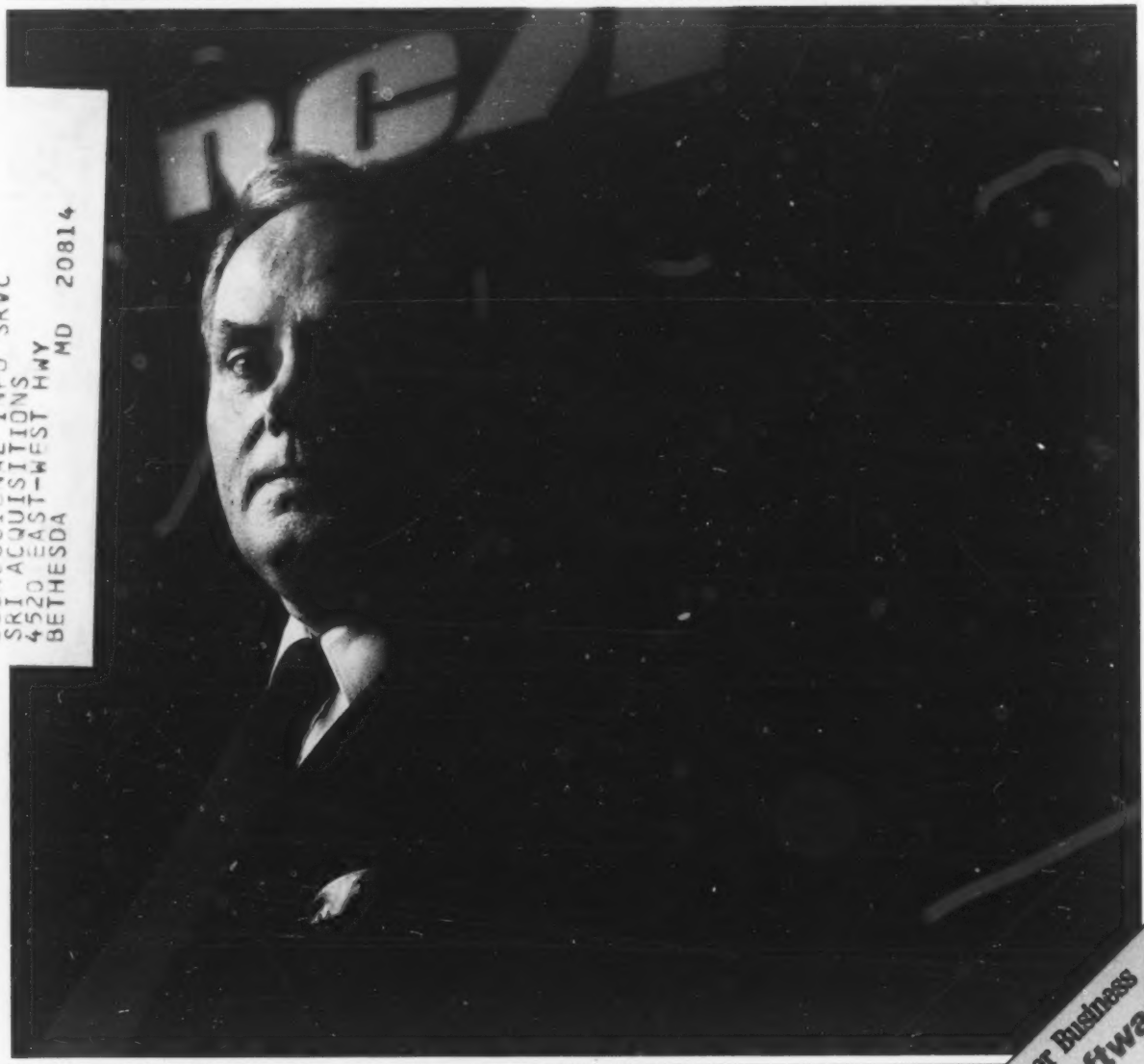
Electronic Business®

It's only a year old, but PS/2 sales take the cake PAGE 76

Hot auto sales put Europe's IC makers in the fast lane PAGE 24



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Cover photo/Jonathan Levine

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BPA ABP

Semiconductors continue to lead the recovery

There's plenty of good news to come. Profits are up, with a little help from the tax man

Sales records are made to be broken in fourth quarters, when companies push shipments out the door. So it shouldn't surprise anyone to learn that the ELECTRONIC BUSINESS Index for revenue, a composite of sales by 16 U.S.-based electronics companies deemed representative of this country's electronics industry, hit a record during the last quarter of 1987. Since most companies are on calendar years, our revenue index surges with the winter solstice. Last year was true to form; revenue for the last quarter was more than 11% higher than for the last quarter of 1986. That increase was enough to push revenue up by almost the same percentage for the whole year.

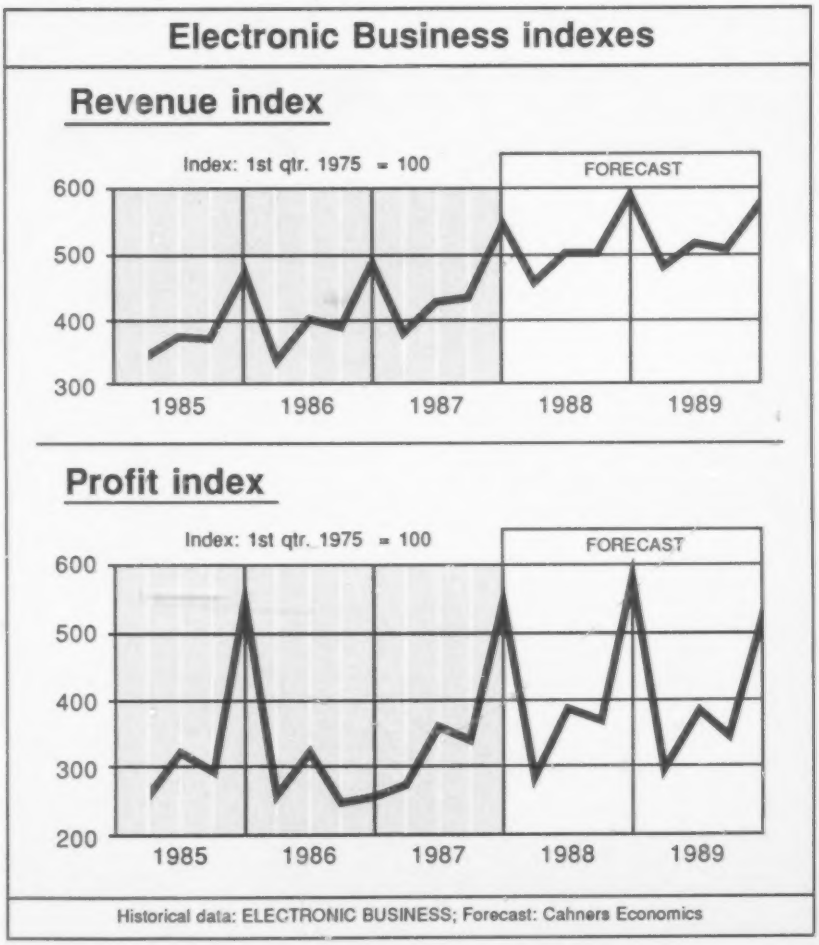
What was surprising was the strength of the profits' recovery in that quarter. Indeed, we had predicted that companies were going to emphasize profits in 1987 [see "Nursing the bottom line back to health," July 1, 1987, p17], but we had not expected the fourth quarter profits index to nearly break records. In fact, it almost tied the previous record, set in the last quarter of 1985. And these profits did set a new record in growth. Profits in the last quarter of 1987 more than doubled those of the year-earlier quarter. For the whole year, profits were 40% ahead of 1986, our index's largest annual increase ever.

This strong showing in last year's fourth quarter came from an unusual combination of forces from both ends of the electronics industry's economic cycle. At the leading end are the components manufacturers, primarily the chip makers, for whom the recovery is in full bloom. They were first in cutting costs; now that they sell more, more of their sales go to the bottom line. At the trailing end are the manufacturers of large computers and capital equipment whose sales have not recovered yet, but who are still cutting costs to stay in the black.

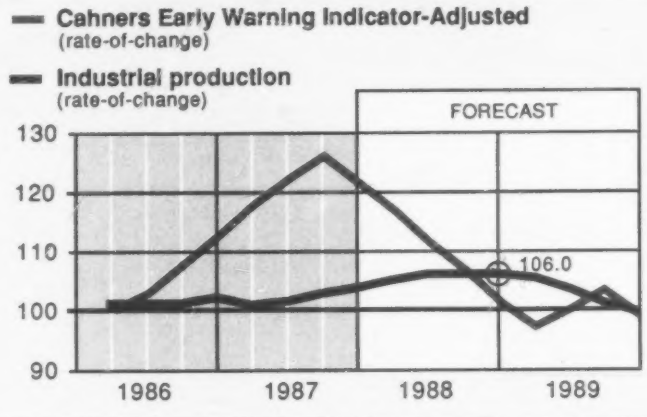
For example, sales by chip maker Intel Corp. were 61% ahead of the last quarter of 1986, and the company's revenue is well on its way to exceeding $2 billion this year. Profits swung from deep red to solid black. On the other hand, IBM is still waiting for the recovery to lift its fortunes. Big Blue's bland performance at the cash register in the fourth quarter — up a meager 6% over 1986 — was accompanied by a dramatic 50% increase at the bottom line. Granted, IBM's profits got a little help from Uncle Sam because taxes in that quarter were lower than in the year before. But those profits still would have been up almost 30%, even without the tax reduction.

Senior economist Elizabeth Baatz of Cahners Economics forecasts that our revenue index will be up 14% this year, but that growth will come almost to a halt in the third quarter of next year. If so, companies at the trailing end of the economic cycle may not have many rich quarters ahead. But then, they did not have many poor ones during the industry's slowdown from 1985 to 1986.

ALBERTO SOCOLOVSKY



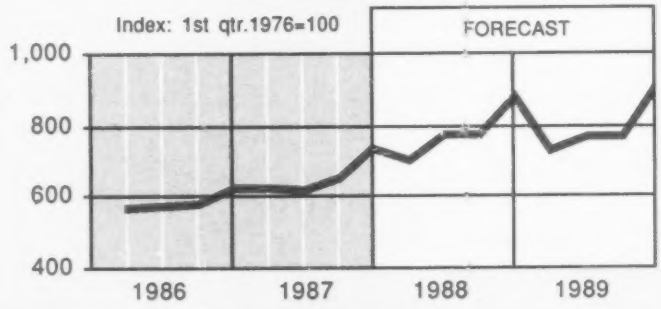
Economic indicators



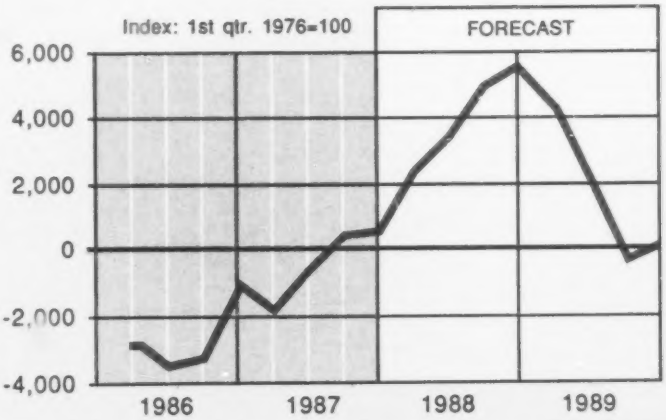
Historical data: Federal Reserve Board; Forecast: Cahners Economics

ATE indexes

Revenue



Profits



Historical data: ELECTRONIC BUSINESS; Forecast: Cahners Economics

Steady growth expected

The United States Index of Industrial Production, a coincident indicator of the U.S. economy, has been climbing steadily since the summer of 1986. During 1987's third quarter, output rose 2.1% from the prior quarter and was up 3.1% year-to-date compared with the previous year. This slow and steady growth is expected to continue until this summer. Production is expected to rebound after a year and a half of sluggish growth, pushing production up 6% this year. The impetus for this upturn will be increasing U.S. exports, due to the decline in the value of the dollar, inventory replenishment and growth in business equipment investment.

The Cahners Early Warning Indicator (CEWI) has been adjusted by deleting the unusual effects of recent changes in financial markets. The adjusted indicator points to an upturn in the economic business cycle, with the next business peak in August of 1988. The CEWI is a weighted average of housing starts, the Dow Jones Industrial Stock Index and the money supply (M2), deflated by the Consumer Price Index. The CEWI has proven to be an excellent tool in forecasting the turning points in the economic business cycles about 12 months in advance. The black curve is a plot of the 12-month rate of change Index of Industrial Production. That change over a 12-month period can be determined by comparison with the line at 100. For example, the 106 level forecasts using the CEWI for the end of this year indicates that the average for all of 1988 should be 6% above 1987.

More information can be obtained from Elizabeth Baatz, economist, Cahners Economics Department, 275 Washington St. Newton, Mass. 02158.

ATE revenue and profit

Fourth quarter 1987 revenue for manufacturers of automatic test equipment rose 12.3% above the prior quarter and increased by an even stronger 17.9% over the year-ago quarter. This strong final quarter boosted annual revenue 11.8% to $1.79 billion. This year, the demand from computer and semiconductor manufacturers for automatic test equipment shows further signs of strengthening. Revenue is expected to rise a sharp 18% this year, followed by a much slower 1.7% increase in 1989. ATE manufacturers returned to profitability during the second half of 1987. Not since the second quarter of 1985 has the ATE index shown positive earnings. Profits are expected to show healthy increases for the rest of 1987 through 1988, with a slowdown forecast in mid-1989.

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SEMICONDUCTORS

The rise and fall of Britain's IC empire

A merger with Ferranti makes Plessey the largest chip maker in England, but Britain still lags the U.S. and Japan

Chadderton is a grim and grey factory suburb on the outskirts of Manchester in the north of England. Its aging buildings contrast with Silicon Valley's spanking modern plants. But this decaying monument to Britain's 2-centuries-old Industrial Revolution is the birthplace of one of the most successful high-tech devices of the 1980s — the gate array.

Gate arrays — basically, semicustom chips — were first devised in a converted textile mill at Chadderton by Ferranti Plc a dozen years ago. The devices have since become one of the fastest-growing sectors of the semiconductor industry.

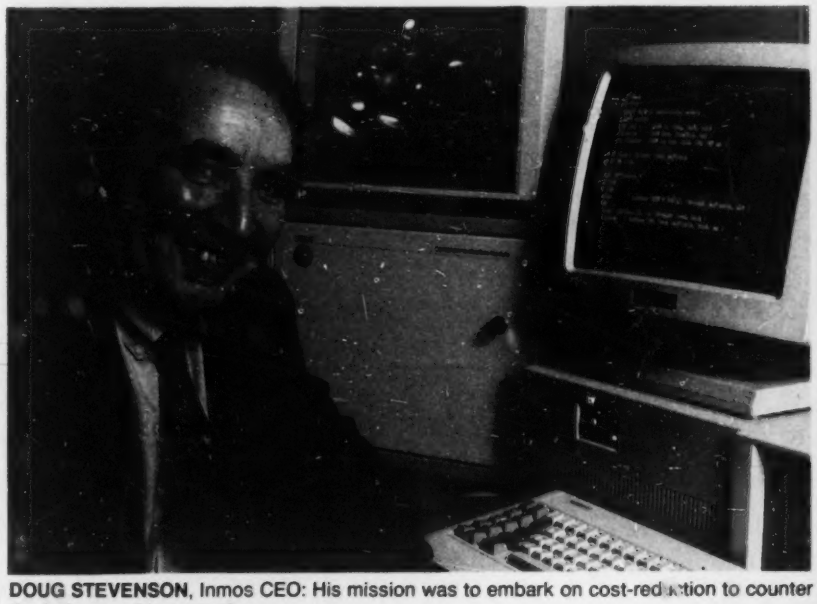
But Ferranti's reluctance to dirty its fingernails with aggressive marketing robbed it of the fruits of imaginative research. Over the years, the British firm has captured only a small part of worldwide gate array sales. Motorola Inc. grabbed Ferranti's leadership in the mid-1980s. Since then, Fujitsu Ltd., LSI Logic Corp., NEC Corp. and others have snatched significant shares of this increasingly profitable business.

Ironically, however, while British electronics firms are not expanding as fast as their rivals, their profit record is the envy of the industry at large. Britain's General Electric Co. and The Plessey Company Plc have been registering returns on sales as high as 10%, putting them well among the world leaders.

However, British chip makers have earned these profits, not in the hurly burly of the international marketplace but in the snug environment of British government defense contracts and equipment orders from British Telecom. Not a single British name figures among the world's top 10 electronics firms.

Accountants and lawyers

That absence underscores the shortage of business talent in Britain. Surveys show that only about one-third of Britain's top executives have



DOUG STEVENSON, Inmos CEO: His mission was to embark on cost-reduction to counter the industry-wide recession

The British semiconductor industry trails the rest of Europe

Source: Dataquest Ltd.

a marketing background. "Our companies are managed by accountants or by lawyers," says Peter van Cuylenberg, the British managing director of Texas Instruments Inc.'s unit in Britain. Business schools, a source of expertise in the United States, play only a minor role in the British environment.

The fast expansion of Britain's domestic telecommunications market explains its healthy sales charts for semiconductors. But most of these come from Japanese and U.S. suppliers. Jan Calen, Motorola Semiconductors' European director of marketing, predicts that the British chip market, which grew by 8.2% last year, will increase by 10.1% in 1988 and reach $1.25 billion (at an exchange rate of $1.70=£1). In Europe, only Italy, starting from a lower base, outstrips this rate.

Calen says: "The British market is driven by communications upsurge, the the best growth segment." According to the Motorola manager, Britain has maintained a steady 18% share of European semiconductor sales for the past two years. This places it behind Europe's biggest chip consumer, West Germany, whose share is 32% but ahead of France's 16%.

However, British firms manufactured less than 50% of the $750 million output of Britain's semiconductor plants in 1986. The bulk of these chips were made by Philips and Texas Instruments in England and by National Semiconductor Corp., NEC and Motorola in Scotland. Digital Equipment Corp. is also preparing a Scottish wafer fab.

Motorola is currently gearing up to make 1-megabit dynamic random access memories at East Kilbride, the only plant outside the United States that it has earmarked to manufacture its latest leading-edge product. Barry Waite, general program manager at the Scottish plant, says: "We high-speed CMOS process and will begin producing at the end of 1988. We're very pleased that we have been chosen as our corporation's leading-edge facility."

Neverthless, Britain continues to lag the United States and Japan in semiconductor manufacturing, as it clings to its traditionally strong position in smokestack industries at the expense of innovation. Although Britain still has a $3.4 billion trading surplus in mechanical engineering, it has slipped from rough equilibrium in electronics in 1970 to a 1986 deficit of $3.4 billion.

British designers might again surprise the world with a new device as revolutionary as the gate array. But could Britain's marketing managers sell it? Ferranti, for example, which last year acquired International Signal and Control, an American defense contractor, still survives as a manufacturer of defense electronics, computers and instrumentation. But it brought down the curtain in November on its venture into semiconductors.

Britain's industrialists and London's financiers regard the chip-making industry as highly risky and too costly

Ferranti's chip business was bought for a meager $56 million by Plessey, whose acquisitions include Stromberg Carlson, the U.S. telecommunications manufacturer. But Plessey was rebuffed by the U.S. Defense Department recently when it tried to take over Harris Corp.

Plessey-Ferranti merger

The new venture with Ferranti is likely to push Plessey's revenue from semiconductors up to $220 million this year and bring it into the top 30 manufacturers worldwide. Thanks to this partnership, Plessey today ranks No. 1 in Europe and No. 6 across the globe in gate arrays.

Jim Beveridge, Director of the European Components Group at Dataquest Ltd., the London-based arm of the San Jose, Calif., electronics market research firm, says: "The merger is fundamentally sound. Britain's semiconductor firms are too small to be viable. They need to cut costs and bring their product lines together."

Ferranti's recently developed capability in using standard cell technology for mixed digital and linear gate arrays is hailed by users as unsurpassed. "We are getting rid of overlap in our product families," says Doug Dunn, managing director of Plessey Semiconductors Ltd. "Now we can derive the benefits of merging our research and development, marketing and design resources."

However, Britain has yet to learn the moral of the Ferranti fable of missed opportunities. The British semiconductor industry is the most fragmented in Europe. Across the English Channel, continental Europe's patchwork of manufacturers have been faster to marshal its own dispersed resources. West Germany's Siemens AG and N.V. Philips GL of the Netherlands have joined forces in the much-vaunted Megaproject to devise powerful memory chips. The leading Italian and French chip makers have allied under the banner of SGS Thomson Microelectronics.

In swallowing Ferranti's chip activities, Plessey has recognized that survival is becoming increasingly precarious for small producers. But Plessey's own niche-based strategy, based on its success with application-

specific integrated circuits, could prove risky if Japanese and U.S. groups use their muscle to turn these chips into commodity products. Comments Iann Barron, chief strategic officer at Inmos International Plc, an imaginative but financially rent British chip firm which is now up for sale: "As the level of integration increases, most ASICs will combine microprocessors and memory. So success will depend on access to microprocessor and memory technology."

However, Plessey is turning a deaf ear to industry watchers who urge it to follow its U.S., Japanese and European competitors into the commodity chip market. John Clark, Plessey's chairman, says: "For 20 years, we have studiously avoided going in for commodity silicon. Massive investment and competitive pricing mean you are chasing your own tail."

Clark adds: "Plessey does not see itself as a national champion redressing Britain's trade imbalance in commodity chips. It's too late for Britain to get into that business. The market for ASICs and USICs [user-specific integrated circuits] is our last chance."

This argument is challenged in a recent report on the British integrated circuit industry prepared for the Department of Trade and Industry by Ian Mackintosh, a consultant specializing in high technology issues. Apart from Plessey, Britain's semiconductor industry is composed of the chip division of STC Plc and Inmos, a subsidiary of the Thorn-EMI electronics group and creator of the "transputer." "What we need is to assemble a chip industry with sales of about $340 million," says Mackintosh. "Only then, will Britain stand a chance in world markets."

Mackintosh's thesis is challenged by many British industrialists and policymakers, including financiers in the city of London. They regard the chip making industry as highly risky and too costly. The British business community also points out that the users of chips account for only a small part of British manufacturing.

Unfortunately, the critics are making a valid point. In 1986, output in Britain of information technology products was worth $20 billion, only 6.5% of total manufactured items. That compares with 20% for information technology-based goods in the United States and 12.5% in Japan. "Growth of the information technology sector is firmly linked with the growth of the semiconductor industry. While the U.S. and Japan have forged ahead in both IT and chips, Britain, like its European neighbors, has lagged behind," says Mackintosh.

The antidumping agreement between the United States and Japan has raised prices of memory chips for European systems makers. This makes it more important than before for British users to have access to off-the-shelf chips from local suppliers. British systems firms are also handicapped because they lack the close contact with semiconductor designers which are so valuable to their U.S. and Japanese competitors.

But the Japanese can recognize a good British chip when they see one. Shortly before its semiconductor operations were merged with those of Plessey, Ferranti was asked by Canon, the photocopier and camera maker, to supply high speed chips for its next generation of facsimile machines. Keizo Yamaji, Canon's vice president says: "We're working with the British firm because no Japanese supplier can provide a suitable chip."

JACK GEE

Transputer: Finding a niche for a new 32-bit chip

Mergers have become the top priority for Britain's semiconductor manufacturers as they watch their competitors in the United States and continental Europe ally to preserve and conquer markets. Inmos International Plc has captured the imagination of electronics designers with the "transputer," a 32-bit microprocessor which combines all the functions of a computer. But this subsidiary of Britain's Thorn-EMI Plc electronics group is feeling even lonelier now that The Plessey Company Plc has taken over Ferranti Plc's chip making activities.

Doug Stevenson joined Inmos as chief executive three years ago from ITT Corp., where he headed microelectronics operations. "I learned a lot from Harold Geneen, the ITT president, about tight budgetary control and planning procedures," Stevenson says.

His mission at Inmos was to embark on cost-reduction programs to counter the industry-wide recession and launch the company's first transputer products. This meant switching volume production of its high performance static random access memories from a facility in the U.S.' Colorado Springs, to Newport, Wales.

Last December, Inmos closed its private plant in Colorado Springs, with the loss of about 300 jobs. Stevenson commented: "We will continue to maintain a strong presence in the U.S. with a nationwide sales organization, customer support, and a test operation delivering military products to the U.S. defense industry."

Iann Barron, Inmos' chief strategic officer, spends about half the year at the U.S. headquarters. "This makes sense," he says. "The U.S. represents 70% of our business."

Closeness to the U.S. market enabled Inmos to score a major success last year. IBM incorporated a variation of the transputer in its new Personal System/2 family of personal computers. The chip is a "color look-up table," an electronic palette which makes it possible to "paint" any point on the PC's video screen in any one of 296 different shades.

But Inmos will remain mired in debt unless it can capture more design wins like the IBM contract, which is believed to be worth more than $20 million dollars up to the end of this year. "Crisis time has arrived for Inmos," says Jim Beveridge, director of Dataquest's European Components Group. "They could be snapped up by a buyer at any moment."

Stevenson comments: "It's not just a question of cash but of getting the right partner. We need to sign up with an electronic group that has the financial muscle to invest in research and development and the ability to put our chips into its products." □

POWER SUPPLIES

There's plenty of power in the power supply industry

Analysts and vendors agree that the merchant side of the market will grow, thanks in part to personal computers

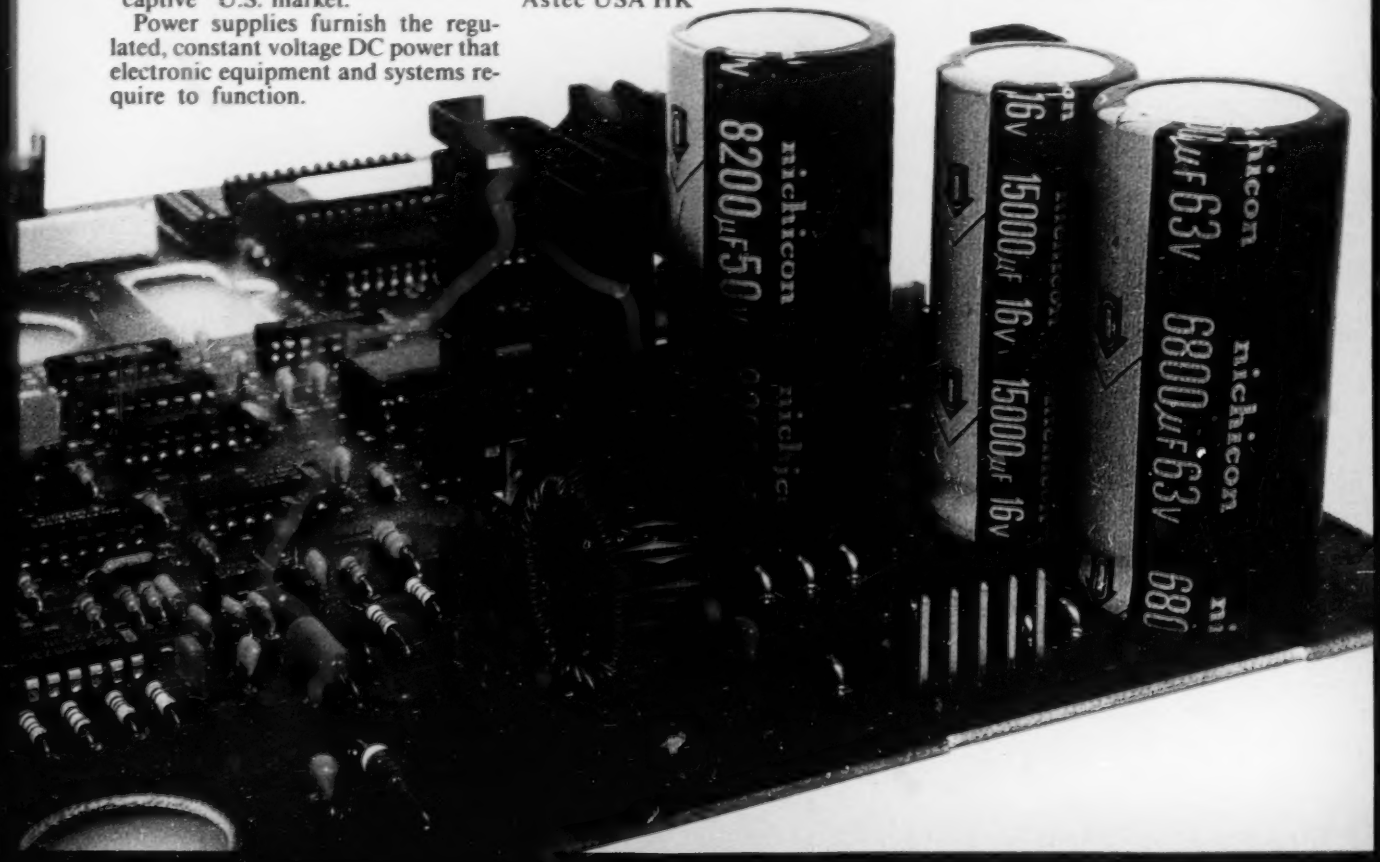
By Lin Sun

About 25% of the area in the IBM ProPrinter's single printed circuit board is taken up by a power supply. Its electrolytic capacitors, coils, heat sinks and switching power transistors tower above the rest of the board's components, a prominence probably matched by their cost. Big Blue builds 3,000 ProPrinters a day, and that is also the number of switching power supplies its popular mass produced, low-cost printer adds daily to the "captive" U.S. market.

Power supplies furnish the regulated, constant voltage DC power that electronic equipment and systems require to function.

More than two-thirds of the dollar value of supplies consumed in the United States this year will be captive, according to Mohan Mankikar, president of Micro-Tech Consultants in San Francisco. Like IBM, AT&T and Digital Equipment Corp., many makers of big systems build their own supplies. But, for small systems such as personal computers, which require low power, low-cost supplies, most companies follow the example of Apple Computer Inc., which buys many of its supplies from Hong Kong-based Astec USA HK Ltd. Thus, Mankikar expects the captive share of the U.S. market to erode slowly, down to 62% by 1992.

Small systems are also driving up the market for switching power supplies — which efficiently regulate the DC output voltage by switching the AC input on and off at high frequency. Mankikar estimates that switchers already account for more than half of the market, and that their share will grow at the expense of linear power supplies. (Linears regulate by dissipating excess power. Thus,



they are less efficient than switchers, but supply a cleaner DC.) The third type of power supplies — DC to DC converters — will also grow and increase share, forecasts Mankikar, but at a rate much slower than that for switchers.

There's no single engine

But figuring out which way the market is heading is difficult, comments Irving Gutman, vice president for marketing and sales at Lambda Group of Veeco Instruments Inc. in Melville, N.Y. Lambda is the largest merchant vendor of power supplies worldwide. That's because power supplies are an attachment to all kinds of computers, telecommunications and electronic equipment. As such, says Gutman, there is no single "engine" in the United States which can drive the whole market. Power supply companies are wholly dependent on the applications in the markets their customers serve.

That's why Gutman and his colleagues in the industry keep a careful watch on the overall economy. "The Wall Street [October crash] has had a dampening effect on the economy," concedes Edward Schneider, president of Computer Products Inc., a leading power supply vendor in Pompano Beach, Fla. Sales rose about 5% last year and orders were up 10%. "But," he says, "the market is growing, and the outlook is encouraging. These problems in the [financial] markets have got to have some unfavorable impact on business, but we haven't seen it yet, and we're far enough down [the manufacturing chain] that we might not feel it for some time."

Mankikar has trimmed 10% off the dollar projections he had made a year ago for the U.S. market, but for a reason totally unrelated to the market crash. "Most of the growth is at the low end," he explains. "That's why companies like Zenith Electronics, which supply the PC clone makers, have grown faster than others, such as Powertec."

Merrill Simon, a board member and consultant for L H Research Inc., a manufacturer of switching power supplies in Tustin, Calif., points out that an upturn in the market may not necessarily mean more business for U.S. companies. "If more power supplies are sold in the U.S. market in 1988," he says, "the issue is: how many of those are going to be imported?"

To compete with the imported supplies, particularly in the low-power range, for personal computer applications, U.S. companies are moving some of their own manufacturing offshore. Computer Products has a 750-worker plant in Hong Kong, and ACDC Electronics, a subsidiary of Emerson Electric Corp., assembles supplies in Mexico. But the competitive advantage of manufacturing offshore is less important for higher power, lower volume units, typically with outputs of over 200 watts.

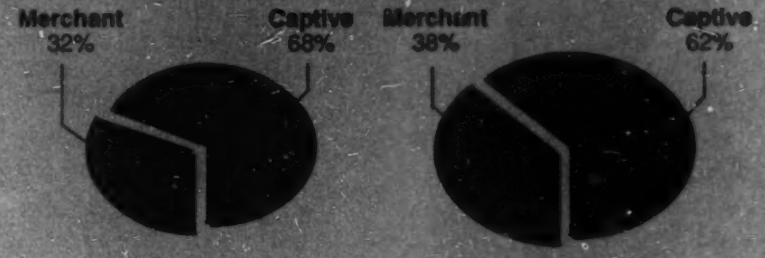
As a result, many U.S. companies concentrate on quality, reliability, service and technology, rather than on pricing issues. "Emphasis on quality has become important and will continue in 1988," says Eugene Zuch, director for corporate marketing at Computer Products. Bruce Hamilton, vice president for marketing at ACDC Electronics, says the interest is in increasing power density and efficiency for the larger supplies. One of the approaches ACDC and others

U.S. consumption of power supplies

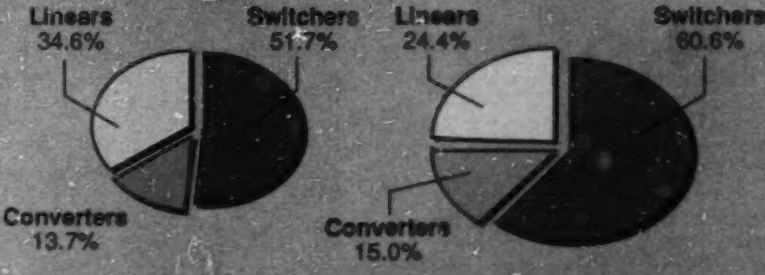
Total 1987 market $5.228 billion

Total 1992 market $7.496 billion

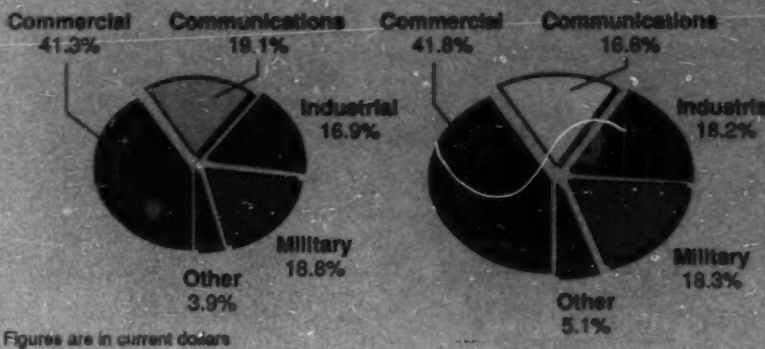
Market by type of manufacturer



Market by type of power supply

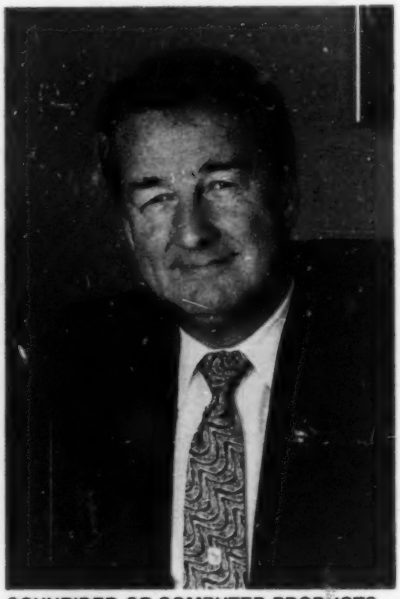


Market by type of application



Figures are in current dollars

Source: Micro-Tech Consultants



SCHNEIDER OF COMPUTER PRODUCTS remains optimistic about the year ahead

are exploring is to use resonant conversion technology (RCT), which allows a switching supply to operate at a higher frequency and thus increases efficiency and reduces the weight of the switcher's magnetic components.

Lambda boasts one of the broadest product lines in the industry, aimed squarely at the medium and higher ends of the original equipment manufacturers' markets. And Computer Products has spent a great deal of time and energy honing its distribution network, which includes major industrial electronics distributors such as Anthem Electronics, Bell Industries, Marshall Industries and Schweber Electronics.

To differentiate themselves from foreign suppliers, U.S. manufacturers are also emphasizing their semicustom capabilities. Although off-the-shelf products continue to occupy the bulk of the market, a large portion of the standardized segment involves modified units — that is, standard products which can meet specific customer applications. Also, as Zuch of Computer Products points out, custom supplies cannot be ignored, if that's what the customer wants — even if standard products are easier to manufacture and service.

Indeed, many customers demand custom supplies. But they usually take 17 to 18 weeks to deliver, according to Roger Lund, product manager for distributor Marshall Industries in El Monte, Calif. Lund notes that distributors now carry a broad range of off-the-shelf power supplies.

Even manufacturers like L H Research, which specializes in custom supplies, candidly admit they wish some customers would seek standard solutions. Simon explains that, even within one product line, each customized model requires qualification approval from the pertinent regulatory agencies such as the Underwriters' Laboratories, the Canadian Standards Association and the German VDE. Even minor changes increase the expense. "You need a huge engineering department" to handle modifications, Simon says. "It is a very unhealthy market trend." □

Top merchant power supply makers

1987 sales ($ millions)

	All power supplies		Switchers only	
	Worldwide	U.S.	Worldwide	U.S.
Lambda Electronics	$150	$90	$117	$61
Shindengen	120	—	69	—
Astec	100	60	100	60
Zenith Electronics	92	77	92	77
Computer Products	85	71.2	47	42.7
Emerson Electric	75	72.5	62.5	60.5
CEAG	70	20-25	50	20-25
ITT Power Systems	60-65	60-65	58	58
Low & Bonar	50-55	30-35	25-30	15-20
Power-One	52	50	15-20	15-20

Source: Micro-Tech Consultants

Essential computer etiquette: Don't interrupt

The rush to make sure that computers get the electrical power they need has led to healthy growth for the uninterruptible power supply (UPS) industry.

"In the long run, the power protection problem will only get more severe — computers are getting faster and their geometries smaller, making them more affected by the quality of power," says John Sullivan, a power consultant in Half Moon Bay, Calif. "But keep in mind that the power is no worse than it ever was. People are just more aware of it."

Sullivan projects that the UPS sector is set to average 20% annual growth in the United States, up from $531 million in 1986 to $1.3 billion in 1991.

An uninterruptible power supply is essentially a battery that stands between the line power and an important piece of equipment, usually a computer. The computer runs off the battery, and the battery is constantly recharged by the line power. If the power fails, the computer won't notice until the 10 minutes or so it takes to drain the battery — long enough for its operators to take emergency action.

Smaller systems are generally solid state, and the current technical trend is a move away from silicon-controlled rectifiers (thyristors) to power transistors.

Systems for the PC level are generally "standby power supplies" (SPS) — they don't power the equipment full time, but only switch in when the line power fails. This makes them cheaper, but they have to be able to supply full power within four milliseconds to be sure the computer won't notice anything.

To supply that performance is no longer particularly difficult, notes Paul Royalty, marketing manager for UPS/SPS maker Topaz Inc. in San Diego, Calif. "All you need is a transformer, a battery, and a printed circuit board," he says. "The circuitry is not very complex." Topaz expects its sales to grow 18% this year.

Adds the Topaz executive: "Four years ago we had about 17 major competitors. Now there are more than 100, representing every garage shop you can imagine, mostly entering at the low end with SPS sys-

PERIPHERALS

Micropolis: Slower growth but a bigger market

As the lines between end markets blur, this disk drive maker expands its product offering and enters new markets

By Bruce C.P. Rayner

Micropolis Corp. has a knack for being in the right place at the right time with the right product. The Chatsworth, Calif., maker of 5.25-inch Winchester disk drives has managed to capture sizable market share in the 85 megabyte and 170 megabyte drive market in the past few years. Now, it intends to use its production and marketing savvy to dominate in the 380MB business. But as 1988 wears on, and the disk drive industry lurches toward maturity, Micropolis is starting to rethink its focus. For the 11-year-old company, it is time to distribute its eggs into more than one basket.

In Micropolis' boardroom, 1988 will be remembered as the year of diversification. And if all goes according to plan, 1989 will see this strategy bear fruit. The $280 million company is developing products that bridge the gap between its traditional market — the professional workstation — and the markets on either side: personal computers and superminis.

In the past, Micropolis has succeeded with a very focused approach to its market. It would let the niche players trailblaze along the leading edge of design and manufacturing, then hop into the fray about three to six months down the line. That way, it avoids major debugging headaches, but keeps visibility on the all-important "window of opportunity." Products are designed and developed in its Chatsworth plant, and when the process is finetuned and suppliers are stabilized, full-scale production is shifted to its Singapore facility, which Micropolis has owned and operated since early 1986.

Customers agree that the strategy has worked. "Micropolis has been very responsive, it [has] an excellent product and they are a very good vendor," says William Greenlund, AST Research Inc.'s product line manager for the Premium/286, AST's personal computer. AST multisources from Control Data Corp. and Microscience International Corp., as well as Micropolis, for 40MB and 70MB formatted drives. Greenlund says Micropolis lives up to its claims of high-quality and very low mean time between faliure (MTBF); and that AST has had very few problems with failure of units.

To date, Micropolis' strategy has enabled it to grow from $23 million in sales for 1982 to $288.3 million last year. Between 1985 and 1986, Micropolis increased sales a whopping 125%. But it is doubtful that growth rates of that magnitude will ever be seen again. James Stone, a vice president and analyst with Merrill Lynch in New York City, expects Micropolis' sales to grow at between 20% and 30% in 1988, a similar figure to its performance in 1987. Stone agrees with other analysts that this year's revenue will be fairly evenly distributed between the three primary products: 85MB, 170MB and 380MB drives.

The storage demands of high-end personal computers are encroaching on the domain of the workstation and Micropolis sees opportunities there for its old 50MB drives as well as its maturing 85MB and 170MB drives. Likewise, in the supermini and high-end workstation environment, Micropolis intends to exploit the demand for high-capacity, high-performance storage, with its unique 1.5-gigabyte parallel array product.

But it does not stop there. Micropolis is spreading the risk further afield. The company is coming out with a half high 5.25-inch 170MB drive and is working on a 760MB

STUART MABON: Micropolis' chief executive and president: "We cannot afford to take advantage of a shortage or to take advantage of a failure of a competitor"

Michael Grecco

drive that will be out by early 1989. Micropolis is also planning the introduction of a 3.5-inch drive sometime in 1989 and continues to spend some research and development funds on optical disk research, although nothing is planned in that market.

Giving birth to the 380

The opinion from the sidelines is unanimous that diversification is essential if Micropolis is to stay competitive. The 85MB drive is fading fast as the choice in the workstation market and the competition is stiff in the new 380MB market from the likes of Control Data Corp. and Maxtor Inc. Since Maxtor introduced its 380MB product in 1986, about 11 other companies, including Micropolis, have entered the market.

Maxtor had a clear lead in the development of its 380MB drive when it ran into supply problems for thin-film drive heads. A nine-month leadtime to market was virtually wiped out by not having a stable supply line. As a result, analysts speculate that Micropolis has a good chance to capture a sizable chunk of the 380MB market.

Sun Microsystems Inc., one of Micropolis' customers, is qualifying vendors for its new "high-capacity" program, says Greg Michael, product line manager for I/O subsystems at Sun. The new system will be in both a desktop and a desk-side configuration, says Michael, and two 380MB disk drive suppliers will be qualified for each system. Micropolis is in the running. Currently, Sun buys both 85MB and 170MB drives from Micropolis as well as units from Toshiba Corp. and Fujitsu Ltd. Similarly, Altos Computer Systems is rumored to have qualified Micropolis for its 380MB drive.

"The process of moving a new disk drive from the laboratory pilot line environment to volume production is akin to giving birth," says Mark Obenzinger, vice president and analyst with investment firm Wood Gundy Ltd. "It takes about nine months before the results are evident." By Obenzinger's reckoning, Micropolis is near delivery for its 380MB drive now. He estimates that the company will move about 8,000 to 10,000 380MB drives this quarter, ending March.

Such a volatile market demands strong management, and consensus from analysts is that Stuart Mabon, Micropolis' chief executive and president, has the right stuff. "I think Stu is a very close controller of the all important parts of the company," comments William Easterbrook, vice president and analyst with Kidder, Peabody & Co. "I think he runs Micropolis with the velvet glove but there is an iron fist underneath. It is exactly what you need in an industry like that," he adds.

Up, up and array

Much of the minicomputer drive business has been controlled by Japanese makers of 8-inch, 9-inch and 14-inch drives. For the over 1-gigabyte worldwide market, Disk/Trend Inc., a market research firm, estimates that Hitachi and Fujitsu combined accounted for over 60% of all shipments in 1986. But with the U.S. dollar's plunge in relation to the yen and the push by companies like Micropolis, Japan is being competitively compromised. Says Mabon: "We are more of a threat to them than they are to us."

For Micropolis, 1988 will be remembered as the year of diversification. And if all goes according to plan, 1989 will be the year of the big payoff

Micropolis' new 5.25-inch clustered 1.5-gigabyte drive is in development now and is being beta tested by a handful of customers. Commercial shipments will start later this year and then take off in 1989. Analyst Easterbrook believes that the clustered drive will only bring in between $5 million and $10 million this year, but will reach the $10 million per quarter level next year. "The cluster product will be a very, very major product for Micropolis," agrees analyst Stone.

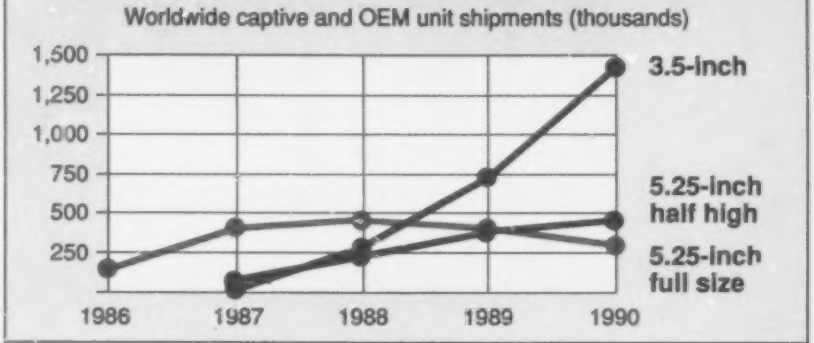
Although Micropolis is on the leading edge for the first time with this product, Mabon insists the risks are minimal. From a marketing perspective, Micropolis will sell the parallel array to existing computer customers like Data General Corp., Hewlett-Packard Co., Sun Microsystems Inc., Unisys Corp. and Wang Laboratories Inc. Also, systems integrators will be targeted as they too sell superminis, high-end workstations, and graphics and imaging systems that demand high-capacity storage. With a dedicated sales staff for the array product, and a high visibility already, Micropolis claims to be well positioned to pressure the Japanese.

On the technical side, much of the innards of the arrayed product are tried and tested. In essence, the unit hooks five 380MB 5.25-inch drives together. What distinguishes it from the daisychaining of drives that has been done by other vendors for years, is that Micropolis has radically improved the reliability of the unit.

By replicating the way a tape drive operates with one drive acting as the parity drive, Micropolis has been able to raise the MTBF of the cluster to 140,000 hours at a sustained data transfer rate of 4MB per second. This is almost five times higher than most 5.25-inch single drives. It uses the small computer system interface (SCSI). "Some customers like the performance, some the packaging, some the price," says Chet Baffa, senior vice president for marketing and sales for Micropolis. At around $12,000 per unit, it is competitive with the larger drives on a megabyte-per-dollar rate.

But just because Micropolis is the first to announce its product does not mean the competition is far behind. U.S. Design, a subsidiary of Maxtor

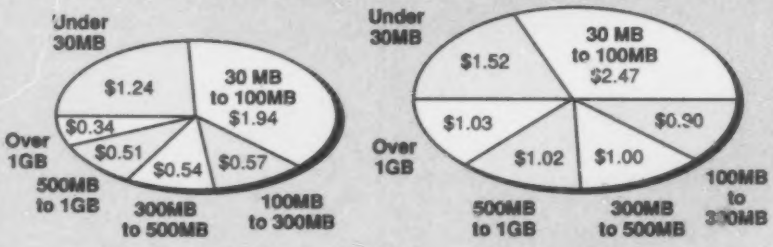
For 5.25-inch disk drive makers like Micropolis, new product development is essential



Source: Disk/Trend Inc.

As demand for disk drives shifts toward higher capacity...

OEM worldwide fixed disk drive revenue ($ billions)

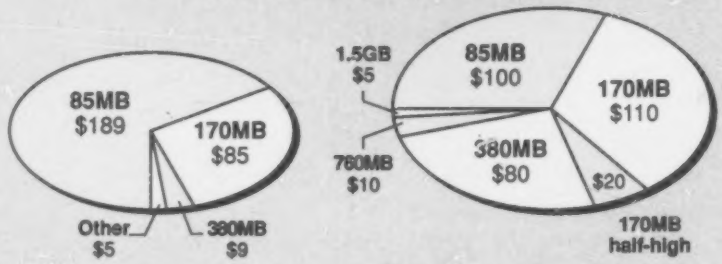


Total 1987 revenue: $5.14 billion

Total 1990 revenue: $7.94 billion

...Micropolis' product mix shifts, too

Estimated product mix ($ millions)



Total 1987 revenue: $288 million

Total 1988 revenue: $325 million

Sources: Disk/Trend Inc. (top), Kidder Peabody (bottom)

Corp., is pushing its 3-gigabyte cluster, as a handful of other vendors are doing. Even IBM is rumored to be making moves in the cluster market. Success in this market will depend on time to market and smoothing out production problems. The clustered drive could prove to be a huge success for Micropolis but Mabon is being cautious with his forecast: "It is still too early to tell," he claims, just how much business Micropolis can expect.

At the other end of the market are the personal computer makers who are also faced with storage-intensive software applications. This is particularly the case with the upcoming gluttenous OS/2 operating system used in the IBM Personal System/2, which demands some 40MB of memory simply to run. Micropolis has no intention of competing with the likes of Seagate Technology and Miniscribe Corp. by developing disk drives for the PC market, claims Mabon, but it does intend to take advantage of the increasing capacity demands. To this end, Micopolis is pushing its 85MB and 170MB drives through new channels and in new parts of the world.

Although a late entrant, Micropolis is starting to place its products on the shelves of electronics distributors and value-added resellers. "It looks like a good opportunity for them," comments Wood Gundy's Obenzinger. Micropolis already has deals with Hall-Mark Electronics, Kierulff Electronics (now a part of Arrow Electronics) and Wyle Laboratories, as well as a host of international distributors.

In total, distribution sales in 1988 are expected to double from around 10% in 1987 to around 20% in 1988, analysts estimate. About 40% of total distribution sales are in the old ST506-formatted 85MB drives but this year, says Baffa, Micropolis will also start pushing the 170MB and 380MB drives through distribution.

Specifically for the distribution upgrade market, Micropolis is introducing a new 170MB SCSI and 170MB ESDI (enhanced small-disk interface) PC Pack designed for PC ATs. It is a follow on from its PC Kit, an 85MB ST506 drive introduced over a year ago. There are rumors circulating that Seagate will be supplying ST506 drives to IBM for its low-end PS/2s, which means Micropolis' PC Kit might take on a new lease on life in the IBM-compatible aftermarket.

The blossoming of Micropolis' personal computer drive was not intentional. "We didn't plan it this way, but we are delighted to see the development take place and we are trying to exploit it as best we can," says Mabon. And the best way to do that is to go to where the decisions are being made.

In the case of the IBM-compatible marketplace, that often means setting up deals with companies in the Pacific Rim. "This is one of the big pushes for the year," says Mabon, referring to Micropolis' push into the Far East personal computer market. Recently, Micropolis set up a marketing office in its Singapore facility to service the reseller market in the Far East. Currently, the majority of foreign sales are to Europe, where Micropolis has marketing offices in England, France and Germany. Foreign sales have declined from 37% in 1984 to 22% in 1986 and are estimated at around 25% for 1987.

But, while opportunities are opening up in the PC and supermini markets, they are closing down with some of Micropolis' older customers. In 1986, Digital Equipment Corp. accounted for over 34% of Micropolis' production. Now, Digital is bringing a lot of its production in house and phasing Micropolis out, especially in the higher capacity arena. Analysts agree that Digital purchased only $40 million, representing about 15% of Micropolis' sales, in 1987. Hewlett-Packard is also cutting down its outside purchases, analysts say, while challenging disk drive makers in their own merchant market. "HP is coming on strong," admits Baffa. Mabon agrees: "HP is going to be a competitor to keep a watch on," he says.

As the capacity and performance of drives from merchant makers increase to 380MB and beyond, captives like Digital and HP are being challenged on their own turf. "What has happened, is the [disk drive] industry has collided with the internal divisions that thought they had a protected market," says Mabon. Micropolis must be able to compete with computer makers like DEC and HP to the point where they have no choice but to buy externally. That means Micropolis must keep its margins down to around 24% and wait it out. "We cannot afford to take advantage of a shortage or to take advantage of a failure of a competitor," says Mabon. "It is really important to us to organize our business around margins that would keep our customers out of the business of making disk drives," he comments. □

DATABASE

Better, but not yet great

The decreases in new orders and shipments for November, although still large, were not quite as severe as the preliminary figures indicated. Revised data from the Department of Commerce place the drop-off in new orders at 14.8% from October to November, instead of 18.5%, and the decrease in shipments at 9.3% rather than 13.2%.

New orders for December regained some of the loss, posting an increase of 4.9%. Computer and office machinery manufacturers had new orders of $55.8 billion for the year 1987, an increase of 3.8% over 1986. Shipments came back 2.1% in December to bring the yearly total to $56.2 billion, virtually the same as the year before. Shipments will have grown almost 11% by the end of this year.

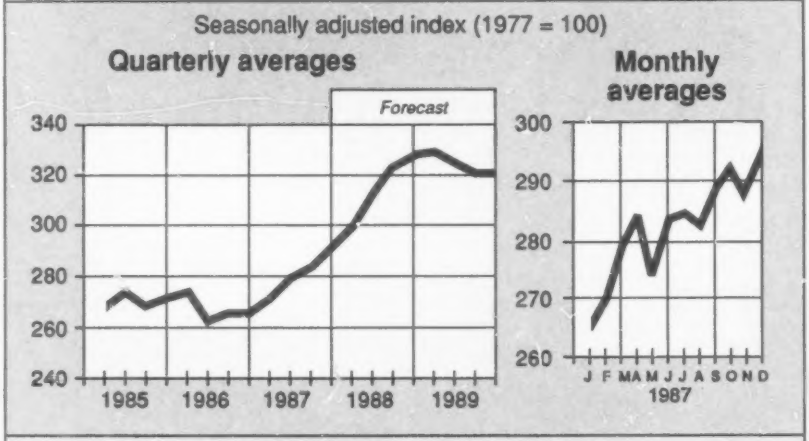
Exports of computers and office machinery surged 11.2% from October to November (note that these figures are not seasonally adjusted), while imports plummeted 17.6%. The $1,883.5 million in exports for the month represented an increase of 31%, compared with the level in November 1986.

Total employment in the computer and office machinery industry averaged 458,700 persons in 1987, 16,500 persons less than in 1986. Employment of production workers dropped 7.8% to average 149,800 persons.

Edited by LINDA STALLMANN

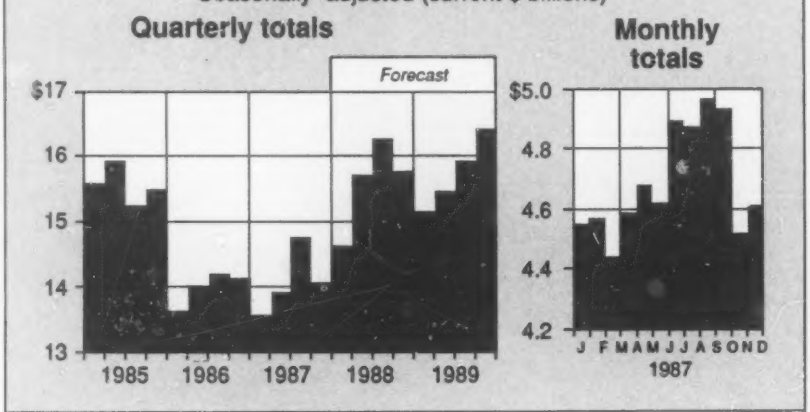
More information can be obtained from Madeline Franchi, senior economist, Cahners Economics Department, 275 Washington St., Newton, MA 02158 Phone: (617) 964-3030.

Industrial production index for computers



Source: Federal Reserve Board; Forecast: Cahners Economics

Shipments of computers



Source: U.S. Department of Commerce; Forecast: Cahners Economics

Computer market database

	Latest month	Previous month	Change	Year ago	Change	Next year	Change
Industrial production (SA,1977=100, December)	294.6	287.2	+2.58%	267.3	+10.21%	329.50	+11.85%
Shipments (SA, $ millions, December)	$4,607	$4,514	+2.06%	$4,956	-7.04%	$5,260.12	+14.18%
New orders (SA, $ millions, December)	$4,530	$4,309	+5.13%	$4,883	-7.23%	$5,227	+15.39%
Unfilled orders (SA, $ millions, December)	$19,039	$19,116	-0.4%	$19,229	-0.99%	$20,254.1	+6.38%
Inventory-to-shipment ratio (SA, December)	2.16	2.17	—	1.99	—	2.03	—
All employees (thousands, December)	470.1	464.89	+1.12%	461.5	+1.86%	492.37	+4.74%
Production workers (thousands, December)	153	152.9	+0.07%	152.7	+0.2%	159.93	+4.53%
Exports ($ millions, November)	$1,883.53	$1,693.52	+11.22%	$1,434.1	+31.34%	$1,798.02	-4.54%
Imports ($ millions, November)	$1,783.99	$2,164.14	-17.57%	$1,620.53	+10.09%	$1,775.33	-0.49%

SA = seasonally adjusted, all other data is not seasonally adjusted

Data sources: Federal Reserve Board, U.S. Bureau of the Census and U.S. Bureau of Labor Statistics
All data for SIC 357, except industrial production, SIC 357-9. Forecasts: Cahners Economics